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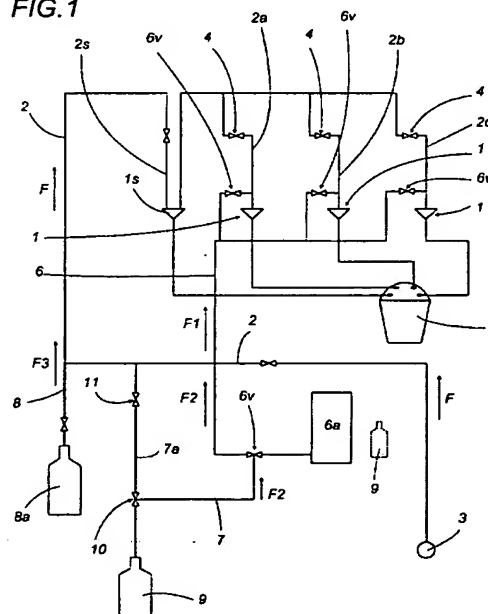
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**EP 1 161 959 A1**

(12)

**EUROPEAN PATENT APPLICATION**(43) Date of publication:  
12.12.2001 Bulletin 2001/50(51) Int Cl.7: **A61L 2/18, A61L 2/24,**  
**A61L 2/26, A61C 1/00**(21) Application number: **01830348.7**(22) Date of filing: **30.05.2001**(84) Designated Contracting States:  
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU**  
**MC NL PT SE TR**  
Designated Extension States:  
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**40126 Bologna (IT)**(30) Priority: **09.06.2000 IT BO000345**(71) Applicant: **CASTELLINI S.p.A.**  
**40013 Castel Maggiore (Bologna) (IT)**(54) **Method for sterilising conduits that convey fluids to medical instruments, especially dental instruments**

(57) A method for sterilising conduits that convey fluid to medical instruments, especially dental handpieces (1) comprises the following steps: removing at least the end portions of supply branches or forks (2s, 2a, 2b and 2c) of the handpieces (1) from their respective rest positions and placing them in a container (5); introducing a sterilising liquid in each of the supply branches or forks (2s, 2a, 2b and 2c) for a predetermined time; and draining the sterilising liquid out of the branches or forks (2s, 2a, 2b and 2c). The final draining step is effected by flushing the inside of the branches or forks (2s, 2a, 2b and 2c) with a sterile fluid that can be supplied through a second branch (7) independent of the main water source (3).

**FIG. 1**

## Description

**[0001]** The present invention relates to a method for sterilising conduits that convey fluid to medical instruments, especially dental instruments.

**[0002]** It is known that the heart of any piece of dental apparatus or equipment is the water and air system. In the system, the water line supplies fluids used by dental equipment and patients (water or physiological saline for tumblers and handpieces), or consumer units (swilling water for the spittoon), while the air line is used for certain items of equipment (air spray handpieces, cooling air and driving air).

**[0003]** With increases in general standards of hygiene and in the "fragility" of dental apparatus and equipment, several advances have been made in the design and function of the fluid systems of dental units not only to guarantee their efficient operation and durability but also to maintain the sterility of the conduits both during and after successive patient treatments. Considering that the basic structure of such fluid systems comprises a first main line supplying water from the mains, and a second main line supplying air from an external source (compressor), each of which has a plurality of branches serving the water- or air-using devices, different systems have been designed on the basis of different methods aimed at improving the functioning and disinfection of these fluid lines or parts of them.

**[0004]** In particular, the present specification focuses attention on the water line which is disinfected according to two different methods, one using a continuous cycle and the other a discontinuous cycle, and requiring additional devices to be fitted to the basic structure of the system: in patents DE - 3.028.550 and DE - 3.611.329, the problem is addressed using equipment comprising a tank of disinfectant connected to a unit for dosing the disinfectant into the conduits that convey the fluid to the devices of the dental unit, in such a way as to supply the water line with disinfected water according to the amount of water required by the devices themselves.

**[0005]** On the other hand, in the solutions based on the discontinuous disinfection/sterilisation cycle, as disclosed in patent publications EP - 111.249 and EP - 317.521 (the latter being by the present Applicant), the mains water supply is shut off, and a dedicated branch equipped with an independent tank is used to feed sterilising liquid into the conduits that supply water to the handpieces. After a preset time, depending on the quality of disinfection/sterilisation required and the properties of the sterilising liquid, the line is opened again and the sterilising liquid drained out.

**[0006]** The drainage of the sterilising liquid is performed by flushing water supplied by the main line and opening the control valves on the handpieces so that the water rinses the water line and flows out into an appropriate drain.

**[0007]** This method, which has been used on dental units for some time, has proved to be very effective and

practical. However, the Applicant, always seeking to improve the sterilisation and post-sterilisation steps of dental units, has made significant changes to the sterilisation method in an attempt to make it safer still, in particular by improving the disinfection level of the step of draining the sterilising liquid out of the line. This is because it has been found that the flow of non-sterile water from the main water source makes it impossible to maintain the sterility of the conduits, thus partly offsetting the sanitising effect of the sterilising liquid.

**[0008]** This sterilisation parameter is very important when it is necessary to use physiological saline for a treatment on a patient. In such a case, the saline is conveyed along conduits that are not completely sterile, thus greatly diminishing the effect of the sterilising cycle previously carried out.

**[0009]** The aim of the present invention, therefore, is to maintain the conduits of the dental unit water lines at the highest possible level of sterility.

**[0010]** Accordingly, the invention, as disclosed in the claims below, provides a method for sterilising the conduits that convey fluid to medical instruments, especially dental handpieces and comprising the following steps: removing at least the end portions of supply branches or forks of the handpieces from their respective rest positions and placing them in a container; introducing a sterilising liquid in each of the supply branches or forks for a predetermined time; and draining the sterilising liquid out of the branches or forks; the final draining step is effected by flushing the branches or forks with a sterile fluid that can be supplied through a second branch independent of the main water source.

**[0011]** The technical features of the present invention, in accordance with the above-mentioned aims, are set out in the claims below and the advantages more clearly illustrated in the detailed description which follows, with reference to the accompanying drawing, which illustrates a preferred embodiment of the invention without restricting the scope of the inventive concept, and in which:

- Figure 1 is a diagram of a part of the water system of a dental unit where the method according to the present invention can be implemented.

**[0012]** With reference to the accompanying drawing, the method according to the invention is used to sterilise / disinfect the conduits that convey fluids to medical instruments, especially handpieces forming part of a dental unit.

**[0013]** The handpieces are generically denoted by the numeral 1 and not illustrated in detail since they are of very well known type. They include a micromotor, a turbine, a scalpel, a scaler, a syringe (labelled 1s), etc.

**[0014]** The dental unit also comprises a line 2 that supplies a fluid (water) from a main water source 3, the water line 2 subdividing into several branches or forks 2s, 2a, 2b, 2c, each corresponding to a handpiece 1

forming part of the dental unit and requiring the fluid for its operation.

[0015] Each branch 2s, 2a, 2b, 2c is equipped with first shutoff means 4, consisting of a valve, that permits the fluid to be supplied when required.

[0016] The method illustrated in Figure 1 is represented through a circuit structure consisting of different lines, corresponding to different steps, with reference to patent EP - 317.521 by the present Applicant, but without restricting the scope of the inventive concept, which may also apply to a circuit structure that is more or less complex than the one illustrated.

[0017] The method essentially comprises the following steps at least:

- removing at least the end portions of supply branches or forks 2s, 2a, 2b and 2c from their respective rest positions and placing them in a container 5;
- introducing a disinfectant / sterilising liquid in each of the branches 2s, 2a, 2b and 2c of the water line 2 through (in the embodiment illustrated) a first branch 6, equipped with a valve 6v, independent of the water line 2 and leading at least into the branches 2a, 2b and 2c (see arrow F1) or flowing into the line itself;
- draining the disinfectant / sterilising liquid at least out of the branches 2a, 2b and 2c of the water line 2 through the handpieces 1 and into the container 5.

[0018] The step of draining the disinfectant / sterilising liquid is performed by flushing the water line and the branches 2a, 2b and 2c of the water line 2 with a sterile fluid that can be supplied by the first branch 6 itself or, preferably, by a second branch 7 (see arrow F2) which is independent of the first branch 6 and of the main water source 3.

[0019] As shown in Figure 1, the method, in this particular embodiment, also comprises a step of closing the first shutoff means 4, thus isolating the branches 2a, 2b and 2c of the water line 2 at least at the shutoff means 4 (that is, downstream of these branches relative to the supply flow direction F) before the step of introducing the disinfectant / sterilising liquid.

[0020] Preferably, the step of flushing with the sterile fluid is at least long enough to allow the disinfectant / sterilising liquid to drain out and the entire water line 2 (besides the branches 2s, 2a, 2b and 2c) which has come into contact with the disinfectant / sterilising liquid to be completely rinsed and flushed through the handpieces 1 located in the container 5.

[0021] After flushing the disinfectant / sterilising liquid out of the line 2, the user fluid can be supplied by the main water source 3 again, thus causing the sterile fluid to flow out and reopening the shutoff means 4 (in the specific embodiment illustrated).

[0022] Alternatively, the method may comprise a step of supplying physiological saline, instead of the fluid supplied by the main circuit 3 and the sterile fluid,

through a third branch 8, independent of the others, equipped with a third tank 8a and connected to the water line 2, which enables the sterile fluid to flow out and remains in the water line 2 so that it can be used during treatment of a patient (see arrow F3).

[0023] In another, simpler embodiment, the first branch 6 or the second branch 7 keeps the line 2 supplied with sterile fluid which can be used during treatment. This may be achieved by providing the branch 7 with a sub-branch 7a leading upstream of the first branch 6 - again relative to the flow F and in the embodiment illustrated, with an independent tank - from where the disinfectant / sterilising liquid comes or connected directly to the first branch 6: in this way, after the step of draining out the disinfectant / sterilising liquid and closing the first branch 6, the sub-branch 7a is opened to allow the sterile fluid to flow continuously into the water line 2.

[0024] As shown in Figure 1, the sterile fluid is supplied by a second tank 9 placed on the dental unit. The tank 9 may be removed from the dental unit, sterilised and the liquid inside it changed or it may itself be changed if it is of the disposable type.

[0025] The dental unit, labelled 100, that implements the above described method accordingly comprises at least one first branch 6, independent and flowing into the water line 2 and at least into its branches 2a, 2b, 2c. The first branch 6 can, when necessary and through second shutoff means 6v, supply the disinfectant / sterilising liquid drawn from a first tank 6a, and after the first tank 6a is substituted with the second, removable tank 9 (see dashed line in Figure 1) which is interchangeable and/or sterilisable, it may supply the aforementioned sterile flushing fluid that may also be used as an alternative fluid during a treatment session.

[0026] Alternatively, the dental unit 100 may comprise a second branch 7, parallel to the first branch 6, equipped with the second tank 9 of sterile fluid (that may be fitted without removing the first tank 6a of disinfectant / sterilising liquid), and supplying the first branch 6 downstream of the first tank 6a through corresponding third shutoff means 10 so as to completely flush the disinfectant / sterilising liquid out of the water line 2.

[0027] The second branch 7 is supplied by the second tank 9 containing the sterile fluid, placed directly on the dental unit 100 and being preferably of the removable, disposable type, or sterilisable if it is not disposable.

[0028] The second branch 7 may be equipped with a sub-branch 7a leading to a point upstream of the confluence between the first branch 6 and the water line 2 and the branches 2s, 2a, 2b and 2c, and able to be activated through a valve 11 in such a way as to flush the water line and make the sterile fluid available for a treatment session.

[0029] The accompanying drawing also shows a third tank 8a containing physiological saline to supply the aforementioned third branch 8 flowing into the water line 2 instead of the sterile fluid. Obviously, since the tanks

are removable and of the disposable or sterilisable type, the third tank 8a may be fitted in one of the two branches 6 or 7 (in place of the first or second tank 6a or 9) without restricting the scope of the inventive concept.

[0030] In all the configurations described, after the water lines have been sterilised, the sterile fluid used to flush the lines can be used immediately to supply the spray handpieces 1 during the treatment of a patient, thus enabling the sterile fluid to be conveyed along a perfectly sterilised line.

[0031] The method thus devised achieves the preset aims thanks to a simple change in the step of draining out or flushing the sterilising liquid performed by introducing a sterile fluid in the supply circuit just sterilised so as to maintain the water line and the fluid subsequently used during treatment at a high level of sterility.

[0032] Advantageously, the sterile fluid may be used for the treatment session or it may be substituted by physiological saline or by the fluid from the main water source.

[0033] This change in the method involves few changes to the dental unit: at most, the addition of another branch which is used to supply the sterile fluid, and which does not alter the basic structure of the dental unit.

[0034] The invention described can be subject to numerous modifications and variations without thereby departing from the scope of the inventive concept. Moreover, all the details of the invention may be substituted by technically equivalent elements.

#### Claims

1. A method for sterilising / disinfecting the conduits that convey fluid to medical instruments, especially handpieces (1) forming part of a dental unit comprising a water line (2) which supplies a fluid from a main water source (3) through corresponding branches or forks (2s, 2a, 2b, 2c) and which for each handpiece (1) is equipped with shutoff means (4); the method comprising at least the following steps: removing at least the end portions of the supply branches (2s, 2a, 2b, 2c) or forks from their respective rest positions and placing them in a container (5); introducing a disinfectant / sterilising liquid in each of the water lines (2) for a predetermined time; and draining the disinfectant / sterilising liquid out of the water lines (2) through the handpieces (1); and the method being **characterised in that** the final step of draining the disinfectant / sterilising liquid is effected by flushing the water lines (2) with a sterile fluid that can be supplied through a second branch (7) independent of the main water source (3).
2. The method according to claim 1, **characterised in that** the step of flushing with the sterile fluid is at

least long enough to allow the disinfectant / sterilising liquid to drain out of the forks or branches (2s, 2a, 2b, 2c) completely so that the forks or branches (2s, 2a, 2b, 2c) are well rinsed.

3. The method according to claims 1 and 2, **characterised in that** the step of removing the handpieces (1) is followed by:

- a step of closing the first shutoff means (4), thus isolating the forks or branches (2s, 2a, 2b, 2c) at least at the shutoff means (4);
- a step of introducing the disinfectant / sterilising liquid in each of the forks or branches (2s, 2a, 2b, 2c) through a first branch (6) that is independent of the forks or branches (2s, 2a, 2b, 2c) and that flows into the latter at a point downstream of the shutoff means (4);
- a step of rinsing the forks or branches (2s, 2a, 2b, 2c) and draining the disinfectant / sterilising liquid out of the forks or branches (2s, 2a, 2b, 2c) by flushing the forks or branches (2s, 2a, 2b, 2c) with a sterile fluid that can be supplied by a second branch (7) which is independent of the first branch (6) and of the main water source (3).

4. The method according to any of the claims from 1 to 3, **characterised in that** the step of flushing with the sterile fluid is followed by a step of supplying user fluid from the main water source (3).

5. The method according to any of the claims from 1 to 3, **characterised in that** the step of flushing with the sterile fluid is followed by a step of supplying a physiological saline from a third, independent branch (8) that is connected to the water lines (2).

6. The method according to any of the foregoing claims, **characterised in that** the sterile fluid is drawn from a tank (9) that is positioned on the dental unit and can be removed from the dental unit.

7. The method according to claims 1, 2, 3 and 6, **characterised in that** the sterile fluid can be used in the treatment of a patient.

8. A dental unit comprising at least one main water line (2) for supplying a fluid drawn from a main water source (3), for each handpiece (1) or dental accessory forming part of the dental unit (100); each handpiece (1) being equipped with first means (4) for shutting off the fluid supply; at least one independent branch (6) flowing into the water lines (2) and, when required, introducing a disinfectant / sterilising liquid in the water lines (2), the dental unit being **characterised in that** it comprises means (7, 9) for supplying a sterile fluid designed to at least

flush the disinfectant / sterilising liquid out of the water lines (2).

9. The dental unit according to claim 8, **characterised in that** the supply means comprise at least a second branch (7) independent of the main water source (3) and of the water lines (2) and flowing into the first branch (6) to introduce the sterile fluid when required in the first branch (6) and then in the water lines (2). 5 10
10. The dental unit according to claim 8, where the first branch (6) is equipped with a first tank (6a) containing the disinfectant / sterilising liquid, **characterised in that** the supply means comprise a second tank (9) of sterile fluid that can be connected to the first branch (6) instead of the first tank (6a). 15
11. The dental unit according to claim 9, **characterised in that** the second branch (7) is supplied by a second tank (9) containing the sterile fluid and positioned on the dental unit (100). 20
12. The dental unit according to claim 11, **characterised in that** the tank (9) is removable and interchangeable. 25
13. The dental unit according to claims 9, 11 and 12, **characterised in that** it comprises a sub-branch (7a) of the second branch (7) flowing into the water line (2) upstream of the confluence between the first branch (6) and the water lines (2), the sub-branch being designed to introduce the sterile fluid in the water lines (2) instead of the user fluid from the main water source (3) when required. 30 35

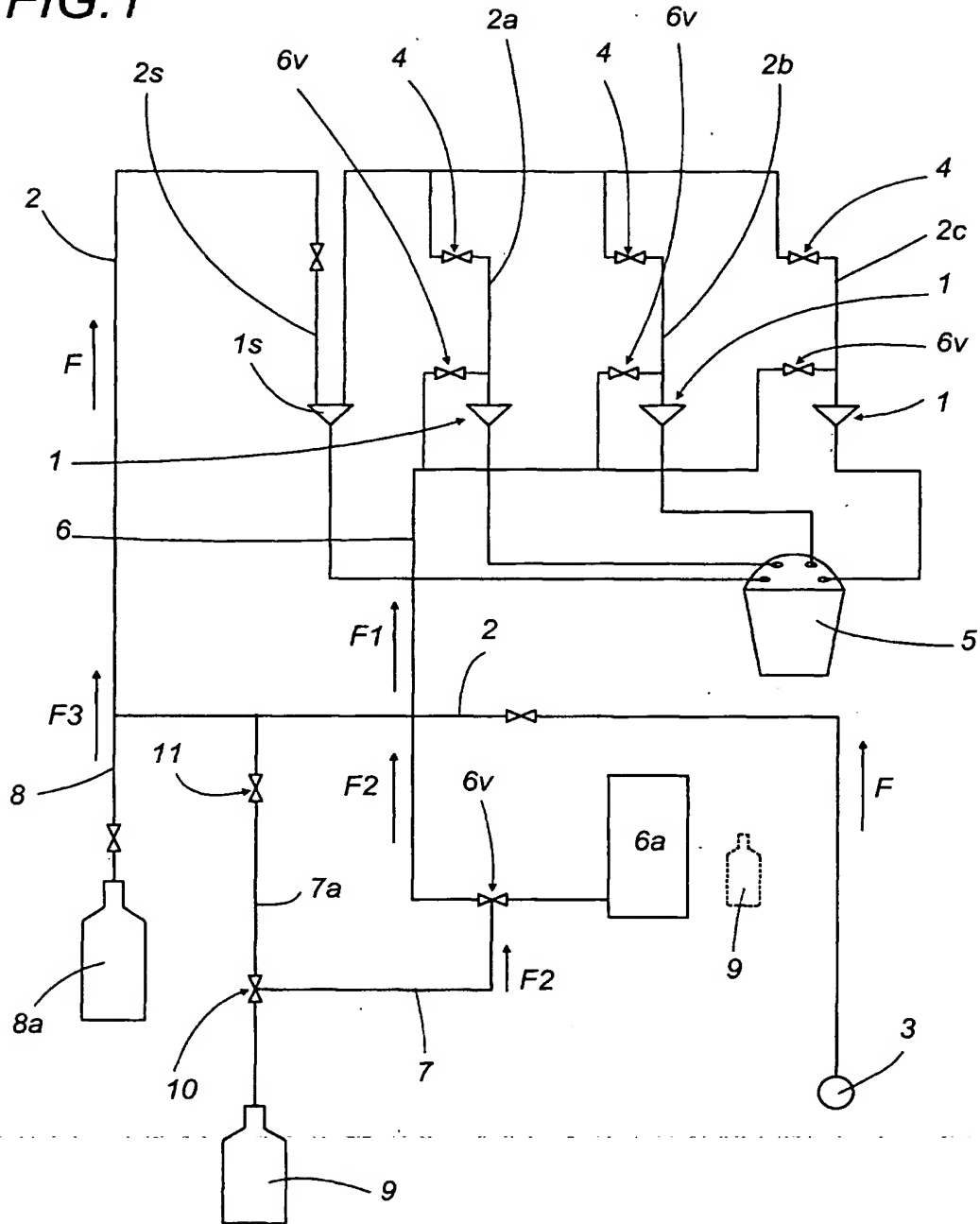
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**FIG. 1**





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## EUROPEAN SEARCH REPORT

Application Number

EP 01 83 0348

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 26 September 2001	Examiner Edmüller, P
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons A : technological background O : non-written disclosure P : intermediate document & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

EPO FORM 1503 03.02 (P04021)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
The members are as contained in the European Patent Office EDP file on  
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